

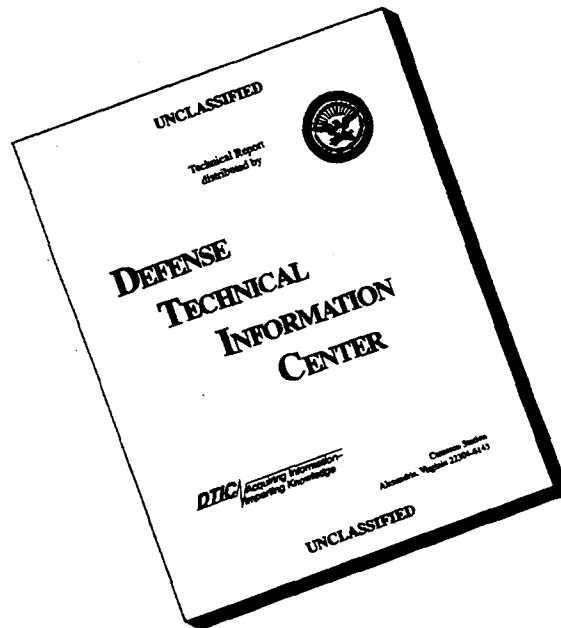
# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE		3. REPORT TYPE AND DATES COVERED FINAL REPORT - 01 Jul 93 - 30 Jun 96	
4. TITLE AND SUBTITLE (AASERT-92) Atom Interferometry and New Cooling Methods				5. FUNDING NUMBERS  61103D 3484/TS	
6. AUTHOR(S) Professor Steven Chu					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Department of Physics Stanford University Stanford, CA 94305-4060				8. PERFORMING ORGANIZATION REPORT NUMBER AFOSR-TR- 960402	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)  AFOSR/NE 110 Duncan Avenue Suite B115 Bolling AFB DC 20332-0001				10. SPONSORING / MONITORING AGENCY REPORT NUMBER  F49620-93-1-0361	
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION / AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED				12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words)				19960813 165	
<p>This AASERT grant has provided research and training support for two students, Heun Jin Lee and Doug Smith. Both are U. S. citizens. Doug Smith has actively participated in a number of experiments using single molecules of DNA as a model polymer system. Heun Jin Lee has co-authored several papers on laser cooling and atom trapping aimed at storing atoms in optical traps for longer quantum coherence times, and lower temperatures and higher densities.</p> <p style="text-align: right;">DTIC QUALITY INSPECTED 4</p>					
14. SUBJECT TERMS				15. NUMBER OF PAGES	
				16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED		18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED		19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	
20. LIMITATION OF ABSTRA					

# DISCLAIMER NOTICE



**THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.**

June 15, 1996

**ASSERT Grant F49620-93-1-0361 Technical Report, SPo #11978  
for the period 1 July 95 to 30 June 96:**

- a. The parent award is AFOSR91-0395 and F49620-95-1-0023.
- b. The parent award was \$199,411 for the period 9/1/92 to 8/31/93 and was to include the support of one full time student. In the period 9/1/93 to 8/31/94, the parent award was \$231,252 and supported one full time student. There was a gap in funding before a new grant, F49620-95-1-0023 was awarded for the period 11-1-94 to 10-31-95 for \$189,406. Incremental funding of \$208,913 was for the period 11-1-95 to 10-31-96.
- c. The ASSERT award primarily supported 2 students, Heun Jin Lee and Doug Smith during this period. Minor amounts of support (roughly \$5,300 in total salary) were also given to Joel Hensley, and "rotation" students, Andrew Kerman, Kathy Pullman, and Dillion Tracy. The total amount given to the students for the period 1 July 95 to 30 June 96 was \$38,498 in salaries, \$10,194 in benefits and \$28,193 in indirect costs.
- d. Certification of US citizenship is attached. Also attached are the transcripts of the student's course work.
- e. During this time period, Doug Smith has actively participated in a number of experiments using single molecules of DNA as a model polymer system. The following work has been published or submitted during the last year:
  - 1) Optical manipulation of Single DNA Molecules, T. Perkins, D. Smith and S. Chu, Physics News in 1994 (Biological Physics Chapter), (AIP, 1994).
  - 2) Self-diffusion of an Entangled DNA Molecule by Reptation, D.E. Smith, T.T. Perkins and S. Chu, Phys. Rev. Lett. **75**, 4146 (1995). (This paper was submitted during the previous year.)
  - 3) Polymer Dynamics with Single Molecules of DNA, S. Chu, S. Quake, T. Perkins and D. Smith, in *Laser Spectroscopy 12*, eds. M. Inguscio, M. Allegrini, A. Sasso (World Scientific, 1996) pp. 419-422.
  - 4) Applications of laser Cooling and Trapping to Precision Measurements and Polymer Physics, B. Young, M. Weitz, J. Hensley, T. Perkins, D. Smith, S. Quake and S. Chu, in *Quantum Coherence and Decoherence*, eds. K. Fujikawa and Y.A. Ono, (North Holland, Amsterdam, 1996) pp 47-52.
  - 5) Dynamical Scaling of DNA Diffusion Coefficients, D.E. Smith, T.T. Perkins and S. Chu, *Macromolecules*, **29**, 1372 (1996).
  - 6) Hydrodynamics of Flow Past a DNA Molecule, R.G. Larson, T.T. Perkins, D.E.

Smith and S. Chu, submitted to Phys. Rev. Lett., (1996).

A plenary talk, several invited talks, seminars and colloquia have already been given on this work. Doug is currently working on a series of experiments that will greatly increase the understanding of the so-called "coil-stretch" transition. Our contributions to this topic will also be included in two chapters in an upcoming book on rheology.

Heun Jin Lee has co-authored several papers on laser cooling and atom trapping aimed at storing atoms in optical traps for longer quantum coherence times, and lower temperatures and higher densities. The following papers were published during this time.

- 1) Optical Traps for Ultracold Atoms, M. Kasevich, H.J. Lee, C.A. Adams and S. Chu, in *Laser Spectroscopy 12*, eds. M. Inguscio, M. Allegrini, A. Sasso (World Scientific, 1996) pp. 13-16.
- 2) Raman Cooling of Atoms in an Optical Dipole Trap, H.J. Lee, C.S. Adams, M. Kasevich and S. Chu, Phys. Rev. Lett. **76**, 2658 (1996).

**Invention Disclosure:**

There have been no invention disclosures or patent applications supported by this grant.

**Personally Identifiable  
Information Redacted**

**Personally Identifiable  
Information Redacted**